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ABSTRACT

A study examined the nature and extent of adult literacy needs in the American labor force. Data for the study were collected from a review of the literature, site visits to nine industry-based training programs, and consultation with a technical panel of experts. Input from company managers, instructors, and trainers familiar with the manufacturing sector indicated that higher-level skills are needed in today's work force than were needed five years ago. As more companies convert to more complex equipment, employee skills must be upgraded. Basic literacy skills were generally seen as prerequisites to the acquisition of more technical knowledge. Basic reading, writing, computation, listening, and thinking skills were seen as necessary prerequisites for successful job entry. Many of these same skills were also deemed necessary to job advancement in the manufacturing sector, and even more analytical (including reasoning and problem solving) and communication skills were considered necessary for advancement than were felt to be necessary for job entry. Pretechnical skills, such as knowledge of algebra and selected writing abilities, were also suggested as literacy needs by respondents from some high-technology companies. Vocational educators are in a position to help industrial trainers design and implement occupationally relevant literacy training in which higher-order literacy skills are taught in a systematic manner. (Appendixes include a generic list of basic skills required for entry into vocational training, the Center for Public Resources basic skills survey list, and descriptions of the six General Educational Development [GED] levels.) (MN)

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ADULT LITERACY:
SKILLS FOR THE AMERICAN WORK FORCE

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FOREWORD

This report examines the nature and extent of adult literacy needs in the workplace. Assembly-line employees are being displaced by the introduction of technologically advanced equipment requiring higher order functioning skills to operate it. More and more responsibility for quality control of products is being placed in the hands of individual equipment operators. Many employees either must upgrade their skills or risk losing their jobs during times of economic recession. This report can be useful to training managers in busines and industry; it can serve to apprise executives of the value of investing in employees. Educators can benefit from reading this report as well. It suggests literacy skills needed to meet industry's productivity needs. The information presented here should also be useful to teachers and administrators of basic literacy programs wherever they are located. Finally, policymakers and public officials can take advantage of the identification of common skills needed to advance productivity in this country and keep American industries competitive with those abroad.

Visits were made to eight plant sites and one training site; only seven are acknowledged because clearance had not been received from two of the corporations at the time this manuscript went to press. This report would not have been possible without the splendid cooperation received from personnel of the following corporations and union:

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Robert E. Taylor
Executive Director
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in Vocational Education

EXECUTIVE SUMMARY

The pool of illiterate adults is growing at an alarming rate in this country. High school students continue to drop out of school. Immigrant adults with limited skills in English join the work force. One estimate from the U.S. Department of Education places the pool of illiterate persons in this country at 2.7 million adults. This pool of illiterate adults has placed a heavy burden on private industry.

This project was initiated to review the adult literacy skills needed in the workplace and to classify those needs according to type of skill, such as reading, mathematics, writing, speaking, and listening. This was done through a review of the literature, site visits to industry-based training programs, and consultation with a technical panel of experts.

Results from the project indicate that higher level skills are needed in today's work force than were needed five years ago. As more companies convert to more complex equipment, employee skills must be upgraded. Basic literacy skills often serve as prerequisites to the learning of more technical knowledge. This knowledge is specific to types of equipment and industries, but the underlying literacy skills tend to be somewhat generic.

The skills addressed in this project were somewhat generic, dealing with mathematics, reading, writing, listening, and speaking. Company managers, instructors, and trainers marked the skills needed to enter and progress on the job. Their responses reflected conditions in manufacturing industries represented by their companies. Skills necessary for successful job entry were the following:

- Reads, writes and counts (math-related)
- Adds, subtracts, multiplies, and divides numbers
- Reads for facts and information
- Writes legibly
- Completes forms and applications adequately
- Signs forms appropriately
- Writes dates and times correctly
- Uses listening skills to identify procedures to follow
- Applies information learned through listening
- Speaks face to face coherently

Skills necessary to advance in these jobs were the following:

- Uses fractions and decimals
- Converts fractions to decimals/decimals to fractions
- Measures with accuracy using English and/or metric
- Solves problems using numbers, fractions, and decimals
- Follows written instructions
- Reads for ideas, logic, and meaning
- Draws conclusions from statements read
- Can detect bias and inconsistencies
- Capitalizes words correctly
- Spells correctly
- Punctuates with commas, colons, and semicolons and uses quotation marks correctly
- Writes legibly
- Writes sentences, paragraphs
- Signs forms appropriately
- Identifies procedures to follow
- Understands concepts, technical information
- Is attentive
- Applies information learned
- Identifies additional information needed
- Distinguishes relationships
- Selects words appropriately
- Has adequate vocabulary
- Speaks face to face coherently
- Gives information/directions clea

Some overlap exists on the two lists, but generally speaking, the skills-to-progress list contains more analytical and communication skills than the job-entry list. In addition, pretechnical skills, such as a knowledge of algebra and selected writing ability, were suggested as literacy needs by persons in high-technology companies.

Vocational educators are in a position to help industrial trainers design and implement occupationally relevant literacy training. Higher order literacy skills, such as reasoning and problem solving, are needed by persons operating high tech equipment. These skills should be assessed and taught in a systematic manner. A comprehensive program to teach basic skills to employees increases employees' adaptability and their value to their employers. By joining with business, industry, and labor to develop and implement literacy programs, vocational educators can contribute to the productivity of the American work force.

CHAPTER 1

INTRODUCTION

Illiteracy and the American Workplace

A great many jobs in American business and industry may be threatened because the influx of sophisticated technological equipment and processes in the workplace is outstripping the ability of many employees to use them effectively. Illiteracy—the inability to read, write, or figure well enough to read a bus schedule or job manual, fill out a job application, or balance a checkbook—is a National problem. In the 1970s, estimates placed the number of illiterate or marginally illiterate American adults at 57 million (Northcutt et al. 1975). Today, the number is probably much higher, and even the most conservative estimates place the number of American adults with inadequate basic skills at a minimum of 60 million (Kozol 1985). (Please note that the terms **basic skills** and **literacy skills** are used synonymously here and include reading, writing, speaking, listening, and mathematics at the level necessary to perform job tasks or advance on the job.)

The reasons that American business and industry are adopting advanced technology are many and well known. Most of them focus on increased foreign competition, increasing costs of materials and labor, and the many production benefits of computerization and related technologies. To keep their corporate heads above water, American companies must produce better quality, lower cost, more customized goods and services for increasingly diverse markets. High technology offers greater productivity, more flexible production processes, lower per-unit costs, and substantially improved quality control.

The employees who operate the new equipment or use the new production or service processes need higher levels of reading, mathematics, verbal and written communication, reasoning and decision-making, and other basic skills in order to do their job tasks effectively and efficiently. The importance of basic skills for employment and employment training was stressed by a national survey (Henry and Raymond 1983) of industry, school systems, and unions conducted by the Center for Public Resources (CPR). The survey found the following:

- Business and industry are finding serious skill deficiencies among the high school graduates and nongraduates coming into entry-level jobs.
- These skill deficiencies pervade all job categories, all types of basic skills, and all types of companies.
- The deficiencies affect not only employee performance in entry-level positions but also employees' qualifications for job advancement.
- A lack of communication exists between industry and school systems on the level of basic skills needed in contemporary jobs and on the seriousness f the deficiencies that exist.

- Rarely does preventive cooperation among industry, schools, and unions deal with basic skill deficiencies in an active way. Most school systems leave the problem in the hands of vocational career counselors. Many companies do not deal with the problem at all.

- Some corporations do offer remedial instruction in basic skills for their employees.

Illiteracy hurts companies, but it also hurts employees. Many companies that modernize choose simply to lay off employees with inadequate skills. Frequently, these illiterates include high school dropouts and "pushouts," legal and illegal immigrants, and refugees (U.S. Department of Education n.d.). Some of these employees are young, but others are older, experienced employees unable or too embarrassed to seek out adult basic education to bring their skill levels up to par with changing occupations.

These adults become part of a complex and costly National unemployment problem. Wellborn (1982) estimates the yearly National costs of welfare programs and unemployment compensation at $6 billion. The cost is high in other terms as well, for illiteracy limits productivity in a broad spectrum of human activities. Even for employees whose skill deficiencies do not result in layoff, illiteracy results in frustration at being trapped in dead-end jobs with no hope for advancement.

What can companies and educational institutions do about the illiteracy problem among American empioyees? How serious is the problem, and what are companies doing about it? What are these literacy skills that so many workers apparently lack? What kinds of skills and knowledge really constitute the best mix of basic skills that American workers need? This report examines a number of these questions and offers some definitive information to help answer them.

About the Study

The National Center for Research in Vocational Education has been interested in the problem of illiteracy in the workplace for a number of years. The National Center first developed models for basic skills instruction (Campbell-Thrane et al. 1983) to meet the educational needs of schools. A later study (Campbell and Sechler 1984) compiled an extensive, generic matrix of the basic skills required to enter vocational training (see appendix A).

This current study builds on the National Center's previous work in the basic skills area. The study's major objectives were as follows:

- To review and classify the adult literacy skills currently needed in private industry

- To study current industry-based literacy training programs by visiting at least nine industry sites

This report focuses on what the project learned in pursuing the first objective. Findings related to the second objective appear in a companion report, *Adult Literacy: Industry-Based Training Programs* (Fields, Hull, and Sechler 1987). To conduct the research, National Center staff convened a panel of technical experts to review the list of basic literacy skills compiled during the National Center's earlier schools-oriented literacy project (Campbell and Sechler 1984). These experts included Leo Kelly, Jr., Director of Continuing Education, Vance-Granville Community College; Susan A. Peterson, Manager of Training and Development, Onan Corporation; and James T. Ryan, Director, Philadelphia Hospital and Health Care District 1199C Training and Upgrading Fund.

The technical panel unanimously approved the list of basic skills as developed by the earlier literacy project. Some additional skills were discussed, but it was felt that they were unique to particular industries and should not be added to the approved list.

Project staff also collected information on the basic skills currently taught by ongoing industry-based literacy training programs. This information was collected during site visits to the nine industry-based training models studied in pursuit of the second objective of the project. Additional relevant information was collected by conducting a review of journal articles and other recent literature relating to industry-based literacy training.

The chapters that follow review the project's findings on the basic skills needed by the American work force for successful entry, performance, and advancement in the changing workplace. Chapter 2 offers a brief history and overview of the responses of business and industry to the illiteracy problem in the workforce. Chapter 3 reviews the common literacy needs in business and industry, as revealed in earlier studies by public sector researchers and the military. Chapter 4 examines the specific basic skills needed in the manufacturing sector, as found by the current study. Chapter 5 summarizes the findings and offers a number of recommendations for company officials, industry training managers and instructors, union officials, public sector educators, and others concerned with basic skills training for the American work force.

CHAPTER 2

BUSINESS AND INDUSTRY FACE THE PROBLEM

Many individuals need to understand the dimensions of the problem of illiteracy facing the Nation today. Specifically, employers, labor leaders, and trainers and training planners in both industry and public education need information on (1) what illiteracy is and what it means to the Nation, (2) how employers perceive the need for basic skills training, and (3) how employers respond to employee illiteracy.

Understanding What Illiteracy Means

Industry's concern with illiteracy is a recent phenomenon, but observers of trends in American society and the National economy have been trying to analyze the problem for some time.

In 1971, the Federal government sponsored a study called the Adult Performance Level (APL) Project (Northcutt et al. 1975) to investigate illiteracy in the United States. The APL project was the first to consider literacy in terms of how well people function rather than in terms of how many years of school they have completed. **Functional illiterates** were defined as persons whose ability in one or more basic skills (e.g., reading, writing, figuring) is limited and unequal to the demands of ordinary daily life, such as reading a bus schedule, filling out a job application, or balancing a checkbook. The APL project found that one-fifth (19.7 percent) of American adults in the mid-1970s were functionally illiterate, and another one-third (33.9 percent) of the adult population was only marginally literate.

A more recent study (Hunter and Harmon 1979) offers new insights into the nature of adult illiteracy in the United States. The study also took the view that literacy is a social and economic function, not merely an educational one. The authors maintained that literacy requirements must be perceived by the individual as well as society, which helps to explain why illiteracy is so hard to combat in certain subpopulations whose educational opportunities and cultural priorities often differ from those of the mainstream culture. According to the study,

> the undereducated, with whom we are especially concerned, are also primarily the poor and racial and ethnic minorities. . . . People who lack basic or functional literacy skills are surprisingly large in number and also suffer from other major social and economic disadvantages. (Ibid., pp. 37, 53-54)

Hunter and Harmon found that the number of functionally and marginally illiterate adults in the late 1970s was about the same as the APL project indicated—somewhere between 54 and 64 million. Blacks, women, and other minorities constituted proportionally large shares of this population.

The study also found that different categories of illiterates had different educational needs and would probably require different approaches and services. The study identified these four types of illiterates:

- **Group 1**—"secure and self-directed persons who respond well to group activities as well as individualized instruction and are open to recruitment through the media"

- **Group 2**—"persons less economically and personally secure; those with large families and seasonal jobs who must often work overtime"

- **Group 3**—"persons who have been only sporadically employed in low-paying, short-term jobs"

- **Group 4**—"those most in need of, yet least accessible to, service . . . the stationary poor" (Ibid., p. 55)

Hunter and Harmon noted that one family can contain members of more than one of these groups. Furthermore, individuals can belong to different groups within their lifetime as their circumstances change.

The researchers felt that literacy programs can most easily reach the first two groups; even members of the second group are motivated and capable, although they often experience time constraints that make rigid class scheduling impractical. The last two groups require more specialized instruction. Group 3 individuals need individualized recruitment contacts and one-to-one instruction. Group 4 individuals, who also require one-to-one instruction, can only be reached through intensive attention. Unfortunately, the project found that among members of all groups, only 2-4 percent of this country's illiterates ever enter publicly funded literacy programs to bring their basic skills up to the high school level.

Hunter and Harmon (ibid.) claim that many people do manage to function despite poor basic skills, but that—

> nonetheless, an enormous gap remains between the number who seek help and those who need it. This gap has important implications both for policies and programs. (p. 103)

In their recommendations, Hunter and Harmon concentrate on this gap. In particular, they are concerned with the most disadvantaged hardcore poor, especially Groups 3 and 4. These are the individuals to be targeted and served by "new, pluralistic, community-based initiatives" (ibid., p. 133).

Those suffering from illiteracy because of minimal education fail to reach their potential despite an ability to function with some adequacy in the workworld. Also as more and more companies adopt high-technology equipment and processes, illiterates who do not improve their basic skills become the first employees in danger of layoff and face the probability that they will never be promoted to high-level jobs.

A culture-of-poverty perspective on illiteracy has been prevalent since the War on Poverty of the 1960s. Fingeret (1984) says that this deficit model tends to lay all the responsibility for illiteracy at the feet of illiterate adults. Another point of view, however, adds Fingeret, finds the larger society fully responsible. Educators with this viewpoint see illiteracy as the result of social structural inequities and class discrimination. Some schools, for example, have been unresponsive to cultural characteristics of students who differ from the middle class.

Fingeret herself believes that

> illiterate adults should be seen as members of oral subcultures, with their own set of vaules and beliefs, rather than as failing members of the dominant literate culture. . . . Many illiterate adults possess common sense, an ability to abstract and analyze that often is downgraded by the larger society in favor of more scientific deductive logic. . . . When the problem is conceptualized as this kind of interaction between structural and cultural factors the programmatic response combines developing critical awareness of these social and political realities on the part of the illiterate adults (empowerment) and working together with them to bring about political and social change. (pp. 14-15)

Employers Grapple with Illiteracy

Companies increasingly acknowledge the problem of illiteracy in the work force but, as noted earlier, many leave the problem in the hands of local public education (Henry and Raymond 1983). Industry executives rarely view the education of employees in basic skills or even more focused technical skills as a means of improving productivity. As Timpane (1982) states,

> corporations do not act as if education has much priority in their calculations. They devote little high-level attention to it; it is rarely considered in corporate strategic planning. They spend very little money on it and have, in fact, used public or foundation resources to achieve some of their most famous successes. (p. 13)

In fact, another recent study (Duggan 1985) found that only 8 percent of the courses offered by employers during working hours are basic remedial courses. The American Society for Training and Development (Carnevale 1983) estimated that less than 1 percent of company training funds in this country are spent on remedial education. But over the past decade, some farsighted firms have recognized the benefits of helping their employees improve their basic skills.

In the 1970s, the Conference Board funded a study (Lusterman 1977) to examine the role of the corporate education and training system in raising employees' basic literacy. The study surveyed 800 companies, each with 500 or more employees, in order to find out how illiteracy problems affected the following:

- Transition of youth from school to work
- Productivity
- Imbalances between job skills and market needs
- Job advancement opportunities for women and minorities
- Avoidance of job obsolescence
- Counseling service for career change

Lusterman's study was the first to draw attention to the emerging illiteracy problem in industry. According to the study, "large numbers of young people complete their schooling without acquiring what by consensus are basic language and arithmetic competencies or reasoning abilities, while many more fall below levels that the length and character of their education would seem to predict" (ibid., p. 4).

The study was also the first to examine seriously the need for remedial basic skills programs for American employees. Examining the relatively few programs that did exist at that time (the mid-1970s), Lusterman pointed out that

> nearly half the companies that provided remedial courses said they did so to train or instruct newly hired employees. Two out of three said that an objective was to improve the skills of present employees; about a third [said] that it was to prepare present employees for new jobs and responsibilities. (Ibid., p. 64)

These statistics are interesting in light of what companies have learned in recent years about training needs and costs. As companies adopt new equipment with advanced technology, it quickly becomes clear how necessary it is to retrain employees to use and manage the equipment. The availability of unskilled jobs in the past provided a haven for illiterates but, as Hymowitz (1981) pointed out, new technology is both eliminating such jobs and creating a need for highly knowledgeable and flexible employees. Many companies also find that the cost of encouraging, developing, and retraining good employees is less than the cost of terminating good but topped-out employees and then hiring others (Stoker 1980).

Lusterman (1977) found that large companies are far more likely to offer functional literacy training to employees. For example, 29 percent of companies in this study with 10,000 or more employees provided basic remedial courses during working hours, while only 14 percent of companies with 2,500-9,999 employees provided such training (p. 49). It may be that only large companies have sufficient resources to establish their own basic skills training programs.

A second significant finding of Lusterman's study (ibid.) was that the illiteracy problem seems to be concentrated in certain industries. For example, the industrial sector most seriously affected by illiteracy problems is the financial and insurance industry. Almost one-fifth (18 percent) of these companies provide basic remedial training to employees—more than double the comparable percentage in any other industry category. Elfenbein (1983) offers some explanation of why this industrial sector has been at the forefront of industry's fight against functional literacy:

> As a labor-intensive service industry that employs large numbers of support staff, the life insurance business is directly affected by poorly prepared entry-level workers. The business needs employees who have good basic language, communication, and computational skills, and can learn new skills with relative ease. (p. 6)

A more recent study (Henry and Raymond 1983), supported by the Center for Public Resources, conducted a survey of corporations, trade unions, and school systems. The survey compared the perspectives of industry and public educators on functional illiteracy and gathered data on the incidence of industry-based remedial training, the costs associated with such programs, and the types of skill deficiencies that occur among American employees.

Henry and Raymond (ibid.) found the seriousness of the work force illiteracy problem to be much worse than was expressed in other studies (i.e., Lusterman 1977; Hunter and Harmon, 1979). For example, one company in the survey estimated that costs in rework and wasted materials due to employee illiteracy problems amounted to $250,000 annually. Also, the survey found that 75 percent of the companies responding had instituted some type of basic skills training for existing employees. One of the companies had a single training director to operate its training program 10 years ago; by 1982 it had 6 full-time, 20 part-time, and several consultant trainers for remedial instruction courses for employees.

Clearly, business and industry are becoming aware that literacy skills are key resources for increased productivity and long-term competitiveness. Carnevale and Goldstein (1983) stated that "the emerging interest in employee training has its deepest roots in changing views of the actual operation and appropriate management of the national economy" (p. 3).

As discussed in the companion report (Fields, Hull, and Sechler 1987) to this study, more and more companies and unions are adopting training programs to help their employees raise the levels of their basic skills. In many cases, companies and unions collaborate with local high schools or community colleges to teach basic skills courses. These programs must serve not only conventional illiterates but also a different kind of illiterate employee—the technological illiterate, whose knowledge and skills in basic technology and science (usually in conjunction with reading, writing, and other basic skills) are inadequate for effective job performance.

The next chapter takes a look at what kinds of skills are considered the essential "basics" for business and industry, as found by earlier public sector and military studies.

CHAPTER 3

FOCUSING IN ON THE BASIC SKILLS

The Need for Skills Lists

This chapter examines basic skill needs in business and industry uncovered in the research project's review of the literature. Curiously, the industrial literature offers little in the way of a list of the adult basic skills required in busines and industry. Even though more and more companies are "training workers at all levels in job-specific literacy skills" (Sticht and Mikulecky 1984, p. 9), no satisfactory, fully articulated list of adult basic skills for industry's needs is available.

The reasons for this appear to be numerous. Some companies choose not to address basic skill deficiencies and refer employees elsewhere for help. Other companies refuse to admit that such deficiencies exist. Another major reason is that rapid changes in technology and related job requirements make it difficult to predict changing skill needs. Any attempt at a comprehensive list would be subject to frequent, almost constant alteration. Yet another reason, according to Mikulecky (1985), is that the link between job performance and literacy is a subtle one. To a large extent, research on this relationship is sketchy and is based mostly on literacy task analyses conducted for military studies. Finally, the skills deemed essential for the service, financial, and other growth sectors are unlike those common to the rapidly changing manufacturing sector (Sherman 1983). In short, different industries emphasize different occupationally relevant skills.

Despite these problems, skills lists are critical tools for personnel managers, industrial training planners and instructors, and planners and instructors in public education. These people need reliable basic skill lists to help them—

- analyze evolving job tasks and job requirements on a periodic basis;
- relate changing job requirements to needed employee skill levels;
- develop hiring and advancement criteria;
- assess the skill levels of job applicants, new hires, and existing employees to determine how well those skills match the job requirements for hiring, advancement, or retraining;
- identify both group and individual basic skills deficiencies in order to plan training programs;
- develop literacy training courses and materials; and
- analyze the effectiveness of such courses or materials.

In addition, basic skill lists help supervisors and trainers communicate with each other about employee deficiencies; they also help industry trainers communicate with outside collaborators

(e.g., local public schools and community colleges) to develop needed literacy training programs. A number of studies do exist that shed light on foundational skills for business and industry that are likely to continue in importance for jobs, regardless of changes in technology or differences in specific industry sectors. The following sections review the relevant findings from studies of the public sector as well as the military.

Early Attempts at Basic Skills Lists for Industry Needs

The CPR Study

The closest thing to an industry-based list of basic skill requirements appears in the CPR study (Henry and Raymond 1983). (See appendix B for the complete list.) This list was generated not by industry but by The Center for Public Resources for use in its survey of industry and public educators on literacy skills. Company respondents were asked to react to the list in two ways: (1) to judge the specific skills needed for any given job and (2) to judge the relative skill level (or skill deficiency) of new hires. The survey clustered adult basic skills into several categories: reading, writing, speaking and listening, mathematics, science, and reasoning.

In responding to the survey's first request—to judge job skill requirements—respondents could add skill categories, and several did. The skill requirement added most often related to employees' ability to cope with the work environment and be consistently productive in it. This ability is generally accepted as a crucial employability skill.

Impressions from Henry and Raymond's survey group of 184 companies and 7 unions on basic skills requirements reveal the following findings:

- Generally, medium competency levels in reading, writing, and reasoning are important for most job categories in all industries.
- High competency in writing skills is important only in secretarial/clerical and managerial positions.
- Writing skills are important but not critical to job entry and retention.
- Medium to high levels of mathematics skills are needed across job categories, with high levels necessary for work in manufacturing, utilities, and finance industries.
- High to medium levels of speaking and listening skills are required for all job categories in all industries. (Unions concur in finding, across job categories, verbal communication skills of the most importance.)
- Medium levels of basic science skills are necessary to work not only in skilled labor and technical jobs but also in secretarial and supervisory positions. (Ibid., pp.13-15)

In judging the relative skill competency of new hires, the survey respondents most often cited skill deficiencies in reading, writing, verbal communication, and mathematics. These deficiencies also affected existing employees' chances for job advancement (ibid., p. 23). However, the study also noted that—

businesses have a hard time translating their general perceptions of basic skills deficiencies among employees into specific assessments of the nature and level of those deficiencies compared to job requirements. (p. iii)

Nonetheless, whether company officials do or do not have problems judging skill deficiency levels for specific jobs, significant deficiencies do exist. For example, Henry and Raymond cited a utilities company in the Northeast that has been having an increasingly hard time finding adequately skilled applicants to hire. Of those interviewed for a typical job, only 10 percent—

> are thought sufficiently promising to be tested. Of those given the set of standardized mathematics and reading comprehension tests, half fail at least one test and fully a third fail both. (Ibid., p. 17)

At another utility company in the West, 39 percent of the out-of-high-school applicants who were tested for job entry scored too low on the company's entry-level math and verbal tests to be hired. And in the Midwest, a financial institution found that 30-50 percent of its new hires with high school diplomas could not complete a math test involving fractions, decimals, and time problems, without exceeding the allowed errors.

Here is a summary of the employee **basic skill deficiencies** noted by the respondents to Henry and Raymond's (1983) survey:

- **Reading**

  —More than 40 percent of the companies say that reading skill deficiencies have negative impact only for employees working in secretarial/clerical and technical positions.

  —The most frequently cited negative impact of reading skill deficiencies on productivity is associated with employees' inability to read and follow written instructions and policies.

  —Other reading skill deficiencies include failure to understand incoming correspondence and orders for goods, inability to fill out an application or training material, and inability to read the terms of one's employment contract.

  —For 40 percent of the companies, reading problems exist in the majority of job categories.

- **Writing**

  —Over 50 percent of the companies say that writing deficiencies exist among secretarial, skilled labor, supervisory, bookkeeping, and managerial personnel.

  —Poor grammar, spelling, and punctuation are the writing skill deficiencies most often mentioned.

- **Mathematics**

  —Companies consistently claim that employees across a range of job categories have mathematics skill deficiencies.

—Nearly 50 percent of the companies say that secretarial/clerical personnel have significant mathematics deficiencies.

—Significant deficiencies in mathematics skills exist among skilled and semiskilled labor, according to 51 percent of medium-sized and 67 percent of large companies.

—These deficiencies exist among supervisory personnel, according to 67 percent of medium-sized and 44 percent of large companies.

—These deficiencies exist among bookkeeping personnel, according to 67 percent of medium-sized and 57 percent of large companies.

—Poor decimal and fraction skills are extremely widespread and of the greatest concern.

—Mathematics skill deficiencies are reflected in employees' inability to do correct inventories, prepare reports of production levels, and measure machine or parts specifications.

- **Reasoning**

—Companies claim that reasoning skill deficiencies are most significant among secretarial, technical, and supervisory personnel.

—Problem-solving skills are seen as crucial for employees who must undergo job retraining.

—Reasoning skill deficiencies are reflected in failure to recognize errors, accidents involving failure to anticipate consequences of actions, and the need for increased supervision.

- **Speaking and Listening**

—Well over 50 percent of the companies say that speaking and listening skill deficiencies exist among secretarial/clerical, unskilled labor, service, supervisory, and managerial personnel. Union executives claim that a similar degree of these deficiencies exists among skilled and unskilled labor.

—As much as two-thirds of these deficiencies reflect low capabilities confronting high job requirements.

—These deficiencies are most frequently reflected in the inability to follow verbal instructions and to express verbally one's problems or ideas, as well as in a negative impact on customer relations and on the general public's view of the company's quality.

- **Science**

—Nearly 50 percent of the companies say that science/ technology skill deficiencies exist in their out-of-high-school hires in skilled labor and technical jobs.

—Business executives express a growing need for secretarial/clerical and bookkeeping personnel to be familiar with electronics and computers.

—Union officials whose members work in industries undergoing job mechanization programs also see a need for science and basic technological skill development. (Henry and Raymond 1983, pp. 18-22)

In general terms, the majority of responding companies cite basic skill deficiencies in the majority of the job categories they list on the survey. A very interesting finding is that in many cases, public school educators and company officials have substantially different perceptions of both the nature and level of basic skill deficiencies among youth entering the work force. Companies judged youths' basic skills as low, but the schools believed that youths' skills were adequate for employment. The areas of greatest disagreement are in mathematics, science, and speaking and listening skills (ibid. pp. 16, 24).

Findings of Other Studies

A number of other recent articles and publications seem to confirm Henry and Raymond's findings. Prominent in these articles are companies' problems with their employees' language and math skills. To deal with these deficiencies, some companies provide remedial skill training before the applicants are actually hired. In other cases, new hires receive remedial training along with veteran employees who also need to boost their basic skills.

Timpane (1982) identified the basic skills needed in industry as general skills of reading, writing, and computing. Timpane set the level of competency as that sufficient to master the technical aspects of entry-level jobs, to learn successively more complex tasks over time, and to communicate effectively and exercise good judgment.

Hymowitz (1981) reported in the *Wall Street Journal* that high school graduates applying for clerical/secretarial positions at a major bank and trust company could not write or spell adequately. Frequently, applicants could not write a complete sentence. Remedial courses offered by the company concentrated on improving employees' spelling, punctuation, and grammar. The company also offered numbers skills training to help employees learn how to remember and transfer numbers with the requisite speed and adequacy.

The same study reported that at a manufacturing company in Pennsylvania, an employee's inability to read a ruler resulted in $700 worth of steel sheet being wasted in one morning. In the same company, employees who could not feed numbers accurately into electronic equipment forced the company to spend $1 million to correct the errors. At an insurance firm in New York, employees' spelling deficiencies required that 70 percent of a week's typed correspondence be redone at least once. Some employees at that company also had problems communicating with clients because of ungrammatical speech; also, many did not know how to use a telephone.

A manufacturing plant in California was forced to fire several young employees because of inadequate reading skills. This same plant had difficulty finding 250 new employees, mostly for machinist jobs, who had sufficient basic skills for the jobs (ibid.).

Business Week ("How Business Is Joining" 1984) reported that an Indiana company hired a consultant to train newly hired secretaries in grammar and spelling. Another firm found it necessary to provide remedial training for immigrants in math and other basic skills. Instructors noted that employees have problems with fractions, but not usually with whole numbers.

A recent survey (Lee 1984) for *Training* magazine revealed that 24.5 percent of the responding companies offered remedial basic education--a 6 percent increase from the previous year.

More than one-fourth of the companies offered remedial reading, 61.4 percent offered training in problem solving, 59.9 percent taught listening skills, 50.5 percent taught writing skills, 55 percent taught public speaking/listening.

Oinonen (1984) surveyed Wisconsin employers and employees, who reported that the following skill areas were in need of improvement and greater training emphasis:

- Basic skills of writing, spelling, grammar, mathematics, and reading (including interpretation of blueprints and instruction)
- Effective speech and oral communication
- Economics of business and knowledge of business operations
- Technology or applied science
- Applied computer literacy
- Flexibility and adaptability to learn new skills
- Human relations and decision-making abilities
- Application and job interview skills
- General positive attitudes toward work
- Knowledge of career ladders and career planning
- Work experience
- Specific occupational and job-entry skills (p.31)

Some other articles that discuss industry-based remedial training mention language skill courses focusing on (1) sentence structure, organization of reports, and simplification of language (McGowan 1983); brush-up training in math, English, and history in order to pass GED exams (Wantuck 1984); (3) training in math, English, typing, filing, basic counting, number skills, word processing, cathode ray tube operation, human relations, interpersonal skills (Feagles 1983), and the like. The Department of Labor has assigned a series of subcodes related to reasoning, mathematical, and language abilities for each occupation in the Dictionary of Occupational titles (DOT). More information on these basic skills by grade levels may be found in appendix C.

Military Studies of Basic Skills

All branches of the military are currently engaged in efforts to address basic skills. Sticht and Mikulecky (1984, pp. 17-30) have described the Army's research and development projects in this area dating back to 1971. The Army currently has more than one project underway.

One of these projects, the Job Skills Education Program*, began work in 1977 to systematize basic skill competencies by occupational specialty. The goal of this activity was to guide curricu-

*Information was obtained in a telephone conversation with Edward Shepherd, Education Specialist, 5 September 1985, at Headquarters TRADOC, Ft. Monroe, Virginia.

lum development for over 90 high-density technical occupations. A description of their analysis process demonstrates what can be done with the aid of computers and sufficient resources to address illiteracy problems thoroughly and comprehensively.

With the asssistance of 1,500 subject matter experts at 20 Army installations, the RCA Service Company first expanded the Army project's group of 7,746 skill level 1 and 2 tasks from 94 military occupations (MOS) plus common tasks into 300,000 task steps that have underlying competencies. Then, the RCA Service Company related the 300,000 task steps to 203 academic competencies with a subset called an MOS Baseline Skills Profile identified for each of the 94 MOS and common soldier tasks. Panels of subject matter experts at four training centers reviewed these profiles to determine the most critical competencies and those already comprehensively taught by each service school. Most of the competencies were identified as critical by at least one training center. At least three training centers identified the same 62 competencies, which were viewed as the most critical in support of common tasks. Finally, a matrix of the critical competencies was compiled.

The competencies were grouped in two ways: in a summary table with math and verbal areas and, also, in the profile under basic skill categories. The categories for the common soldier's tasks were as follows:

- Numeration/place value
- Units of measurement
- Visual/spatial relationships
- Geometry
- Computing and performing math processes
- Content reading
- Information access
- Visual aids perception
- Written communication
- Verbal communication
- Safety/security
- Perceptual processes

Approximately 60 percent of the 203 competencies have been identified on the common soldier task profile.

The Florida State University is currently developing curriculum based on these 203 competencies. Using the matrix can help the Army determine which competencies have the potential for a high training payoff because they are also required to support skill level 1 and 2 common tasks.

The Job Skills Education Program was 35 percent complete in September 1985, with curriculum development completion expected by the end of September 1986.*

Conclusions

Public sector studies, training journal articles, and the basic skills research done by the military confirm the general areas of literacy skills needed by American employees. These fall into broad categories of reading, writing, speaking, listening, mathematics, reasoning, decision making, problem solving, computer literacy, and safety awareness. For some industries, introductory levels of science skills and knowledge also apply.

Patterson and Pulling (1981) suggest that functional literacy includes human as well as work skills. These writers claim that a literacy level corresponding to junior high school achievement is adequate to function effectively in American society.

It is clear that companies believe that literacy requirements vary by job category (Henry and Raymond 1983). One list of basic skills, unless it is a generic pool, may not be adequate. Further compounding the listing problem is the changing nature of many jobs, which results in changes in basic skill requirements. These changes are hard to predict, even for narrowly focused job clusters.

Since business and industry have not seen fit to compile adult basic skill lists, vocational educators may be able to make a contribution—assuming their lists are applicable. The disparity found by Henry and Raymond (ibid.) between the literacy perspectives of school, on the one hand, and companies on the other, makes it difficult to arrive at one list of adult basic skills for the workworld. The chapter that follows reports on the results of this project's attempt to develop such a generic skill list upon which both educators and company officials can agree.

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*Further information on this project, "Needs Assessment to Define the Training Requirements for a Basic Skill Education Program (BPSEP) Curriculum Development," may be obtained by writing the Defense Technical Information Center, Cameron Station, Alexandria, VA 22314.

CHAPTER 4

BASIC SKILLS FOR THE WORKPLACE

Constructing the List

National Center project staff took a list of basic skills (Campbell and Sechler 1984) developed in an earlier National Center study of literacy needs to enter vocational training and used it as a point of departure for developing a list to be shared with company officials and trainers. The original generic list of basic skills appears in appendix A. In some of the lists the skills are sequential according to learning need. Listening and speaking skill lists, however, are not.

This original list was presented to the project's technical panel for review and discussion. The panel advised project staff that the list should be simplified and condensed for easier review by company personnel. Project staff shortened the list and, in some cases, modified items to reflect more recent findings given in the literature (reviewed in chapter 3). The decision was made to omit science and reasoning skills, as the need for these varies considerably from industry to industry and across various job levels.* Instead, the project confined the items on the list to those that more readily fit the project's definition of **literacy skills:**

> Those basic skills that enable adult emplyees and prospective employees to learn and perform tasks on the job and in the training environment, thus increasing the likelihood of their being hired, advancing on the job, and participating in more advanced training opportunities.

The final skill categories used by the project were as follows:

- Mathematics
- Reading
- Writing
- Listening
- Speaking

Skills within some categories were arranged in sequential, prerequisite order; that is, one must master the first item or items before proceeding to the rest. The sequential order is tentative, however, and has not been validated by research.

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*Elements of reasoning skills remain in some of the items (e.g., the "draws conclusions" item under listening skills). Upon further research and reflection, project staff would include these skills in future lists of basic literacy skills.

Validating and Refining the List

The items on the project's basic skills list were presented to company and union trainers and training managers at the nine industry training sites for review and reaction. Most often, this part of the data collection effort was conducted following the verbal interview with the site personnel. Respondents were asked to verify that the skills within each skill category are those that they consider essential and basic to successful job performance. Respondents were also asked to indicate whether specific basic skills are essential to (1) entering a job in the company or (2) progressing on the job (e.g., learning to perform an upgraded job or obtaining a job promotion) in the company.

Table 1 lists the basic skills in rough sequential order within each of the five major skill categories. The table also indicates whether industry trainers and training managers judged the skills as critical to job entry or job progression, as shown by checkmarks in the relevant columns. Some skills do not have checkmarks; this means that only a few respondents at the nine sites indicated that these skills are needed for job entry or progression. It may be that most of the raters assumed that these skills are subsumed by other skills in the list.

It should be noted that raters were not asked to evaluate skill needs for specific occupations under their supervision. Instead, the checklist reflects general knowledge—the raters' best estimates of what employees need to know at their companies.

Responses to the List

Mathematics

As shown in table 1, the company trainers and training managers felt that entering employees must be able to read, write, and count, as well as add, subtract, multiply, and divide numbers with relative competence and accuracy. But to progress on the job, they must also be able to work accurately with fractions and decimals, as well as convert fractions to decimals and vice versa, when needed. Employees affirmed this information about the need for fraction skills, saying that they need to know how to work with fractions in order to operate quality control equipment.

The raters also judged two other mathematics skills as crucial to progressing in the job: (1) measuring with accuracy using English and/or metric measurement systems and devices; and (2) solving problems using numbers, fractions, and decimals. Respondents did not checkmark skills in estimating areas or values or in using a calculator. Presumably, the raters felt that these skills are subsumed within the other mathematics skills on the list.

Though the respondents did not so indicate on the generic skills list, project researchers learned through the interviews that several of the industry training sites—particularly those in electronics and other high-technology companies—consider pretechnical skills such as first-year algebra as additional basic skills needed by their employees to perform successfully in highly complex work tasks. At least one company viewed mechanical hand dexterity as a prerequisite to adequate skill in measuring.

Reading

Raters indicated that the most important reading skills for progressing in the company were those associated with reasoning and logic: (1) following written instructions; (2) reading for ideas,

TABLE 1

SKILLS NEEDED BY EMPLOYEES TO ENTER AND PROGRESS ON THE JOB

Skill Categories	Skills Needed To	
	Enter	Progress
Mathematics		
Reads, writes, and counts	X	
Adds, subtracts, multiplies, and divides	X	
Uses fractions and decimals		X
Converts fractions to decimals/decimals to fractions		X
Measures with accuracy using English and/or metric		X
Solves problems using numbers, fractions, and decimals		X
Estimates areas or values		X
Uses a calculator		
Reading		
Pronounces consonants and vowels correctly		
Pronounces syllables correctly		
Pronounces each word correctly		
Discriminates among visual words		
Reads for facts and information		
Follows written instructions	X	X
Reads for ideas, logic, and meaning		X
Draws conclusions from statements read		X
Can detect bias and inconsistencies		X
Writing		
Knows letters of alphabet		
Can copy texts		

Skill Categories	Skills Needed To	
	Enter	Progress
Capitalizes words correctly		X
Spells correctly		X
Punctuates with commas, colons, semicolons, dashes, quotation marks correctly		X
Handwriting is legible	X	X
Uses correct grammar		
Writes sentences, paragraphs		X
Writes letters, reports, messages		
Completes forms and applications	X	
Signs forms appropriately	X	X
Writes dates and times	X	
Listening		
Identifies procedures to follow	X	X
Understands concepts, technical information		X
Is attentive	X	X
Identifies the main idea from a speech		
Draws conclusions		X
Applies information learned	X	X
Identifies additional information needed		X
Distinguishes relationships		X
Speaking		
Selects words appropriately		X
Vocabulary is adequate		X
Speaks face to face	X	X
Uses telephone well		
Gives information/directions clearly		X

logic, and meaning; (3) drawing conclusions from written material; and (4) detecting bias and inconsistencies in written material. Skill in following written instructions was also judged equally important for entering a job. The fact that this is the only reading skill checkmarked as necessary for job entry attests to the relatively low level of skills required by many of the companies visited.

Curiously, the raters marked a lower proportion of reading skills as necessary to job entry or progression than they did any of the other categories. Yet all of the programs investigated teach reading, some to the exclusion of other subjects. It may be that the raters assumed that the unmarked skills (e.g., pronouncing consonants, vowels, syllables, or words) are subsumed by other skills farther down the list.

Raters at one site suggested two additional skills within the reading category: (1) the ability to read safety signs and (2) the ability to read and understand blueprints and engineering materials.

Writing Skills

According to the training staff and managers at the nine industry training sites, employees need to be able to spell, punctuate, write legibly, use sentences and paragraphs correctly, and sign forms appropriately in order to progress on the job. To enter a job, employees need the ability to write legibly, complete forms and applications accurately, sign forms appropriately, and write dates and time correctly.

The entry-level writing skills come as no surprise. Most companies assess potential hirees by reviewing applicants' job application forms. Clearly, people who cannot write legibly and complete the forms with appropriate and accurate information will quickly have their appication forms dropped from the potential hiring pool.

Raters at high-technology firms also suggested the additional need for technical writing skills among employees who draft reports for engineers.

Listening Skills

Raters judged listening skills as important for both entry and advancement in a job. Three skills were equally important for either case: (1) identifying procedures to follow through listening carefully, (2) being attentive to what is said, and (3) applying appropriately information that has been obtained by listening. The training staff and managers also identified a number of additional listening skills that are crucial for progressing on a job: (1) understanding concepts and technical information obtained by listening, (2) drawing conclusions from what has been learned through listening, (3) identifying additional information, and (4) distinguishing relationships among information gained by listening.

The only listening skill that did not receive checkmarks in either column is the ability to identify the main idea from a speech. Apparently, raters felt this skill is subsumed within the other listening skills. However, several company officials did emphasize the need for employees to understand instructors—a skill that presumably includes the ability to detect the main idea in verbally delivered instruction.

Speaking Skills

Most of the communication in the workplace occurs on a face-to-face basis. It is therefore vital for supervisors and others to be able to communicate clearly and directly in words and sentences.

Adequate skill in speaking face to face was rated necessary for job entry as well as for job progression. But the raters further indicatd that for job progression, employees also need skill in selecting appropriate words to say, drawing from an adequate vocabulary, and giving information and/or directions clearly.

It is interesting that none of the respondents marked skill in using the telephone as a requisite speaking skill. This may reflect that fact that most employees in plants are not allowed to use the telephone while they are working (although there clearly are important exceptions among clerical and other employees). The raters did suggest two additional speaking skills, however: (1) the ability to discuss technical ideas clearly with engineers and (2) the ability to discuss problems on the assembly line with supervisors or work-team leaders.

Conclusions

Overall, the site respondents confirmed the skills on the National Center's generic skill list. A larger survey of employers and training staff would be needed, of course, for the list to be truly generalizable. But the contents of the list are also supported by the skills lists compiled by Henry and Raymond (1983) and by the military (Sticht and Mikulecky 1984).

It is interesting to note from the National Center project findings that the companies whose skill ratings were collected still seem to have relatively low skill expectations of job applicants. The raters judged only the following 11 skills as necessary for successful **job entry:**

- Reading, writing, and counting (math-related)
- Adding, subtracting, multiplying, and dividing numbers
- Following written instructions
- Writing legibly
- Completing forms and applications adequately
- Signing forms appropriately
- Writing dates and times correctly
- Using listening skills to identify procedures to follow
- Using listening skills attentively
- Applying information learned through listening
- Speaking face to face coherently

Despite this short list of verified job-entry skills, all of the sites visited offer basic skills training for new and experienced employees, and most of those programs teach basic skills not included in this brief list. In addition, raters did not checkmark 14 basic skills included on the National Center skill list. Those skills were either subsumed by other skills on the list or considered not important by the raters for manufacturing industries. Those skills are the following:

- Estimating areas or values (math-related)
- Using a calculator
- Pronouncing consonants and vowels correctly
- Pronouncing syllables correctly
- Pronouncing each word correctly
- Discriminating visually among written words
- Reading for facts and information
- Knowing the letters of the alphabet
- Copying texts accurately

- Capitalizing words correctly
- Using correct grammar
- Writing letters, reports, and messages
- Identifying the main idea from a speech
- Using the telephone well

The raters selected 24 basic skills they felt were crucial to progressing in a job. (Job progression can mean either working effectively on a job that is being upgraded or getting a promotion). Seven of the basic skills were the same skills marked as necessary for job entry. These seven skills are the following:

- Following written instructions
- Writing legibly
- Signing forms appropriately
- Using listening skills to identify procedures to follow
- Using listening skills attentively
- Applying information learned through listening
- Speaking face to face coherently

An additional 17 basic skills were judged to be important in progressing in a job, as shown in table 1.

Finally, some respondents suggested additional skills that they considered basic but that did not appear on the National Center basic skill list:

- Pretechnical skills, such as first-year algebra (for electronics and high-technology companies)
- Mechanical hand dexterity needed for adequate skill in measuring
- The ability to read safety signs
- The ability to read and understand blueprints and engineering materials
- Technical writing skills for employees who draft reports for engineers
- The ability to understand instructors (listening-related)

Although these additional skills suggested by the advanced technology industries may not be appropriate for other companies, the National Center's generic list does specify the fundamental capabilities needed by almost any employee entering manufacturing industries today. Thus, the skill list should be useful for planners, developers, and trainers in industry, unions, or secondary schools and community colleges who are involved in upgrading the literacy skills of the American work force.

CHAPTER 5

SUMMARY

The Basic Skills That Workers Need

What are these literacy skills that so many employees apparently lack? The project found that they include reading, writing, speaking, listening, and mathematics skills. Many companies believe they also include reasoning, problem-solving, and decision-making skills. For electronics and other high-technology industries, pretechnical levels of science and math (e.g., first-year algebra) also apply. And of course an increasingly large number of jobs now require some level of computer literacy. Patterson and Pulling (1981) estimated that literacy skills at the junior high school level are sufficient to function effectively in American society. But for the workplace, high school graduate-level skills are becoming a requisite for entering and advancing in many jobs.

The skills contained in the National Center's generic skills list (see table 1) represents 42 fundamental capabilities needed by many employees in the workplace today. The list is based on earlier research (Campbell and Sechler 1984) conducted at the National Center and has been verified by (1) comparing its contents with earlier industry-focused skills lists compiled by the Center for Public Resources (Henry and Raymond 1983) and the military (Sticht and Mikulecky 1984), (2) discussing and refining the generic list with members of the project's technical panel, and (3) soliciting industry training managers and instructors to respond to the list and evaluate its relevance to the job-entry and job-progression requirements in their own companies. Because of their generic nature, the skills in the National Center's list cut across a wide variety of the many different work tasks performed in a company.

Clearly, traditional companies—i.e., those with low basic skills requirements, or none at all, for their work force—are unlikely to be concerned about what kinds of basic skills training to offer their employees. This is unfortunate, though, because fewer and fewer companies that cling to this management and job function model are likely to survive in the changing marketplace. Many of these firms, in fact, have become aware of the need to change and are in the process of moving to a more employee needs-oriented model.

Many companies find that they need to offer basic skills training to incoming and existing employees. These companies are most likely to gear their literacy training programs to teaching the foundational cluster of the basic skills. Those skills, which the industry-based training program managers or instructors marked or implied as being essential to successful job entry or to entry-level performance, are the following:

- Reading, writing, and counting (math-related)
- Adding, subtracting, multiplying, and dividing numbers
- Following written instructions
- Writing legibly
- Completing forms and applications adequately

- Signing forms appropriately
- Writing dates and times correctly
- Knowing the letters of the alphabet
- Discriminating among visual words
- Using listening skills to identify procedures to follow
- Using listening skills attentively
- Applying information learned through listening
- Speaking face to face coherently

In addition, these companies increasingly need to attend to changes in job content that amount to job upgrading and require additional, although intermediate, basic skills. These are the skills checkmarked in the Progress column on table 1.

Flexible/organic companies, with their orientation to long-range skill needs in the work force, will require all of the literacy skills on the National Center's generic skills list. These firms will require that employees have higher levels of these skills as well. In addition, they will need more and higher levels of cognitive, problem-solving, and decision-making skills. And finally, they will probably have to add a number of additional skills that other companies do not consider "basic," such as computer literacy, pretechnical science and mathematics, technical writing, public speaking, and others.

Advanced high-technology companies have much higher skill needs than other companies; they will almost inevitably have to upgrade their employees' skills by offering industry-based training programs, either through a company training department or in collaboration with local public schools and/or community colleges. Such companies will also have to provide more frequent skills updating as a consequence of their "fast track," high-technology orientation, because job functions will change and broaden more rapidly than in other companies. The benefits of this investment, however, will be manifold, and for many high-tech industries whose product lines are in continual flux, the investment may make the difference between profit and loss.

Recommendations

The availability of an industry-focused generic skills list has a variety of implications for both industry and education policies and practices. Of course, the generic nature of the list and the fact that industry skill needs are in constant flux restricts the list's usefulness as a comprehensive instrument. Even so, the list can help guide decisions made by company and union officials, training managers, training program planners, instructional materials developers, personnel officers, and supervisors responsible for recruiting and hiring new employees and making promotion decisions. Furthermore, the list can help guide the decisions of administrators, planners, and instructors in public schools or community colleges collaborating with industry in delivering basic literacy training for the American work force. The remainder of this section offers recommendations to help these persons meet the changing literacy needs of the American workplace.

1. Literacy program planners should use the basic skills list to help outline training programs for industry

Those companies examining their present organizational development should find the basic skills list useful for plotting out, verifying, or updating the content of their literacy training programs. Because table 1 shows which skills are needed for job entry and which are needed for job advancement (including upgrading of job skills in a position), program planners will be able to target specific skill area training for new or existing employees, if they so choose.

Companies looking at future organizational development should double-check the content of their training programs with the skills on the generic list to ensure that their programs offer instruction in all of these skills. Such companies will also want to address many or all of the additions to the generic list that were suggested by the high-technology industry sites visited by the project researchers. These additional skills include computer literacy, pretechnical science and mathematics, and others.

2. **Literacy program curriculum developers and instructors should use the basic skills list in developing and delivering training.**

Those who develop and use instructional materials for industry-based literacy training should find the generic list useful to guide the emphasis of materials or instruction. The list can function as a checklist for gearing literacy instruction to specific company operations by providing instructional examples and practice exercises that relate both to the job context and to the relevant basic skill cluster (e.g., reading skills, or listening skills).

3. **Task analyses should be used to determine the levels of the basic skills taught in industry-based training programs**

Although the project research developed a practical, generic basic skills list, the research did not determine at what levels of competence the literacy skills should be taught, except in very general terms. The level of literacy skill competence is, however, crucial information in targeting basic skills training for a specific industry, company, or occupational cluster. An ideal method for determining the specific skills and skill levels for a program is the DACUM (**D**eveloping **A** **C**urriculum) method, a relatively new and innovative approach to occupational analysis. (For more information on DACUM, refer to Norton [1985]).

4. **Task analyses should be used by companies for periodic verification and updating of literacy program content.**

Because of its generic nature, the National Center's basic skills list should remain useful for most companies, regardless of their stage of organizational development, for many years to come. However, future-oriented companies will experience ongoing changes in literacy skill requirements—they will most likely need ever-higher levels of competency. For such training programs, the DACUM method's efficiency and simplicity offers a valuable adjunct to the generic skills list to help companies evaluate and update their literacy training offerings.

5. **Companies should use the generic skills list to help establish entry-level and promotion skill requirements for jobs.**

The National Center's generic skills list provides practical information on the kinds of basic skills that company managers and trainers feel are critical to successful entry-level job performance, successful job upgrading, or promotion. Personnel officers and supervisors who are responsible for setting hiring and promotion policies may wish to consult the skills list when establishing or revising hiring or promotion guidelines. This will save the company time and money in (1) hiring or promoting truly eligible new employees, (2) bringing new hirees or newly promoted employees "up to speed" on their new jobs, and (3) providing vital information to company training department personnel charged with planning remedial or other literacy training for new and existing employees.

6. **Local high school and/or community college administrators and teachers should use the generic skills list to develop basic skills components of collaborative industry-based literacy training programs.**

Whether a local school or college is training company employees on a subcontract basis or is evaluating the relevance of its own instructional programs, the National Center's skills list can be used to guide program content development or updating. Schools and colleges must address the work-related basic skill needs of their students, since most adults will participate in the work force at some point in their lives. Schools and colleges that prepare youth and adults for the world of work through vocational-technical training cannot afford to ignore the expressed skill needs of business and industry. Obvious differences of opinion exist between public-sector educators and the private sector on how well youth are prepared for a productive work life. The basic skills list provides a starting place for reconsidering instructional program content and competency levels. For schools and colleges involved in collaborative basic skills training programs for industry, the basic skills list presented in this document offers a means of mutual communication and understanding upon which to establish program outlines and content.

7. **Further research is needed to develop basic skills lists for specific industrial sectors or occupational clusters.**

The responses of companies to the National Center's generic skills list make it clear that different industries have different basic skills needs that go beyond those on the current list. Such skills might include pretechnical science and mathematics, computer literacy, technical writing skills, and others that are considered basic and essential to successful job performance in different industries.

Additional research is also needed to pinpoint the critical literacy skills in major occupational clusters. For example, the ability to spell correctly or to use the telephone well would be important for clerical/secretarial employees, but much less so for machinists. On the other hand, the ability to measure accurately using Engish and/or metric measurement systems and instruments would be crucial for machinists, but of considerably less importance to most clerical/secretarial employees. The generic skills list provides a starting place for this work, but the need for more pertinent, focused basic skills information in industry-based training programs remains.

APPENDIX A

A GENERIC LIST OF BASIC SKILLS REQUIRED FOR ENTRY INTO VOCATIONAL TRAINING

Mathematics

A. **Read, Write, and Count**

The adult will be able to perform the following whole number operations:

1. Given a series of numbers in numeral form (e.g., 10, 20, 30), copy the series in handwritten form.
2. Identify place value of digits in a given whole number with up to seven digits.
3. Read a given whole number of less than 10 million and write it out in words.
4. Write a whole number of less than 10 million when given the number spelled out in words.
5. Count a set of up to 100 objects and state or write the number of objects counted.
6. Arrange a set of whole numbers in ascending or descending order.

B. **Whole Numbers**

Given appropriate whole number problem sets, the adult will be able to solve problems involving the following:

7. Addition of whole numbers without and with carrying
8. Subtraction of whole numbers without and with borrowing
9. Multiplication of whole numbers without and with carrying
10. Division of whole numbers with quotients expressed, if necessary, with whole number remainders
11. Division of whole numbers with quotients expressed, if necessary, with fractional or decimal remainders
12. Rounding off to the nearest whole number

C. **Fractions**

Given appropriate fraction and/or mixed number problem sets, the adult will be able to solve problems involving the following:

13. Addition of common and mixed fractions with like and unlike denominators

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SOURCE: Most items in this list have been reproduced with permission from Cooney (1980) and Dunn, Gray, and Martini (1982).

14. Subtraction of common and mixed fractions with like and unlike denominators
15. Multiplication of common and mixed fractions
16. Division of common and mixed fractions

D. **Decimals**

Given appropriate decimal number problem sets, the adult will be able to solve problems involving the following:

17. Addition of simple and mixed decimals
18. Subtraction of simple and mixed decimals
19. Multiplication of simple and mixed decimals
20. Division of simple and mixed decimals

E. **United States Customary (English) and Metric Measurement**

Given appropriate United States customary (English) or metric unit measurement problem sets, the adult will solve problems involving the following:

21. Linear measurement with accuracy to the nearest unit necessary
22. Area measurement with accuracy to the nearest unit necessary
23. Volume and capacity measurement with accuracy to the nearest cubic, fluid, or dry unit necessary
24. Mass or weight measurement with accuracy to the nearest unit necessary

F. **Numeric Relationship**

Given appropriate problem sets, the adult will solve problems involving the conversion, in either direction, of the following:

25. Common fractions and decimal fractions
26. Common fractions and percents
27. Decimal fractions and percents
28. United States customary measurement units and equivalent metric units

G. **Simple Linear Equations and Other Problem Solving Skills**

Given appropriate problem sets, the adult will solve problems involving the following:

29. Estimation and approximation
30. One and two-step linear equations
31. Identification of the information and operations necessary for, and the solution of, applied problems such as time, rate, and distance
32. Use of a hand-held calculator

Examples of Mathematical Tasks in Vocational Training

Read gauges and dials.
Total a bill for services.
Calculate a discount.
Convert temperature from Fahrenheit to Centigrade.
Calculate the number of square feet of a room's floor.
Measure the distance between two points.
Determine the diameter of a pipe.
Calculate the proportions of ingredients for a recipe.
Estimate the amount of lumber required to build an object.
Inventory the number of items in stock.
Weigh produce.
Determine cost per unit.
Calculate overhead costs.
Calculate the number of yards of material needed for a pattern.
Organize decimal numbers in descending order of magnitude.
Determine the cost of a job based upon an hourly rate of pay.
Determine the time it takes to travel between two points based on an hourly rate of speed.

Reading

A. Letters of the Alphabet and Numbers

1. Given letters of the alphabet in manuscript form and in random order, the adult will pronounce each letter correctly.

2. Given the letters of the alphabet in manuscript form and in random order, the adult will read each letter correctly in the proper alphabetical order.

3. Given whole numbers, fractions, decimals, percents, and simple Roman numerals, the adult will pronounce each correctly.

B. Visual and Auditory Discrimination

Sounds

4. Given a list of word pairs orally, the adult will indicate which word pairs rhyme and which don't.

5. Given a list of word pairs orally, the adult will indicate which word pairs begin with the same sound and which pairs don't.

6. Given a list of word pairs orally, the adult will indicate which word pairs have the same vowel sound and which pairs don't.

7. Given a list of word pairs orally, the adult will indicate which word pairs have the same ending sounds and which pairs don't.

Consonants

8. *Beginning consonants:* Given a familiar word and a list of consonants the adult will make new words by substituting each of the consonants for the initial one in the original word. The adult will pronounce each newly formed word correctly.

9. *Beginning consonant blends:* Given orally a list of words that begin with consonant blends, the adult will correctly identify the letters making the initial blend sound. Initial blends will include:

   dr, fr, bl, cl, fl
   sc, sm, sp, cr, tr, br
   st, gr, pl, sn, sl, sw
   gl, sk, pr, str, spr, tw, squ
   scr, shr, thr, spl, kn, ch, gn, pn

SOURCE: Most items in this list have been reproduced with permission from Cooney (1980) and Dunn, Gray, and Martini (1982).

10. *Final consonants:* Given orally a word ending in a consonant and a written list of letters, the adult will identify from the list the final consonant.

11. *Final consonant blends:* Given orally a list of words which ending with consonant blends, the adult will correctly identify the letters making the final blend sound. Final consonant blends will include:

    ft, sk, t, sp, ld, rd, rk, rt,
    nk, nd, ng, n**C**i**C**v

Vowels

12. *Short vowel sounds:* Given one-syllable words having short vowels in initial or medial position, the adult will blend the sound patterns together to produce the correct sound.

13. *Long vowel sounds:* Given a list of one-syllable words with a short vowel, the adult will make new words with a long vowel sound by adding a final E and will pronounce the new word correctly.

14. *Vowel diphthongs:* Given a list words having the vowel digraphs au, aw, ew, eu, oo, ou, ie, and ei, the adult will pronounce each word correctly.

15. *Vowels with "r":* Given a list of words containing a single vowel followed by the letter r, the adult will pronounce each word correctly.

16. Given a one-syllable word in which there is a single vowel at the beginning or in the middle, the adult will pronounce the vowel with a short sound.

17. Given a one-syllable word that has a single vowel at the end, the adult will pronounce the vowel with a long sound.

18. Given a one-syllable word with this pattern: CVCE, the adult will pronounce the vowel with a long sound.

19. Given the letter combinations: ai, oa, and ea in one-syllable words, the adult will pronounce the combination according to the more common pattern of making the first vowel long and the second vowel silent.

20. Given one-syllable words in which the letter combinations er, ir, and ur appear, the adult will pronounce the combinations as "ur".

21. Given a one-syllable word in which **a** is followed by **r**, the adult will pronounce the sound neither long, nor short, but as in the word "car."

22. Given a one-syllable word in which a vowel is followed by two consonants and a final e, the adult will pronounce the vowel with a short sound.

23. Given the letters ti, ci, or si in a word, the adult will pronounce the combination as "sh."

24. Given a word in which c or g is followed by e, i, or y, the adult will pronounce those letters with a soft sound.

25. Given a list of words, the adult will identify those that have a schwa sound in an unstressed syllable.

26. Given a list of words containing the four sounds of "y," the adult will pronounce the words correctly.

27. Given a list of words containing the different sounds of "gh" and "ght" the adult will pronounce the words correctly.

Syllables

28. Given a multisyllable word in which two consonants follow the first vowel, the adult will divide that word between the two consonants. (Students will recognize that consonant blends and digraphs are treated as a single consonant.)

29. Given a multisyllable word in which a single consonant follows the first vowel sound, the adult will divide that word in two possible places V/CV VC/V and give three possible pronunciations (vowel as long, short, or schwa).

30. Given a word in which the letters -le follow a consonant, the adult will divide the word making the cle letters a single syllable.

31. Given a word in which there are prefixes or suffixes, the adult will syllabicate that word showing that prefixes and suffixes form their own syllables.

32. *Prefixes, suffixes, roots:* The adult can state the meanings of common Latin and Anglo-Saxon prefixes, suffixes, and roots.

33. *Accents:* The adult can list the 4 basic clues for finding the accented syllable:

    Clue I: The accent falls on a root, generally , when one or more prefixes or suffixes are added.

    Clue II: The accent generally falls on the syllable that precedes these suffixes: sion, tion, ic.

    Clue III: For words of three or more syllables, one syllable generally stands between the accented syllable and the silent "e" syllable.

    Clue IV: The accent generally falls on the syllable that precedes the vowel "i" when this letter occurs before a final syllable.

C. **Basic Sight Words**

34. Given the Barnes Revised Dolch list of 193 words, the adult will read all words correctly.

D. **Reading for Facts and Information**

35. Given appropriate reading material, either prose or abbreviated sources,* the adult will be able to obtain needed factual information.

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*Abbreviated sources of reading material include tables of contents, glossaries, indexes, outlines, forms, and graphic presentations such as charts, schedules, tables, graphs, maps, figures, and diagrams.

E. **Reading for Instruction**

36. Given appropriate reading material, either prose or abbreviated sources, the adult will identify and follow procedures and directions to achieve some specific end.

F. **Reading for Ideas**

Given appropriate reading material, either prose or abbreviated sources, the adult will be able to read and subsequently demonstrate adequate understanding of the following:

37. Cause and effect relationships
38. Sequential and temporal relationships
39. General and technical concepts
40. Physical and social principles

G. **Reading to Infer Meaning**

Given appropriate reading material, either prose or abbreviated sources, the adult will do the following:

41. Use context clues to determine the meaning of unfamiliar words (e.g., experience clues, synonym clues, association clues, previous contact clues)

42. Examine the structure of unfamiliar words to determine if there are recognizable parts that give clues to their meaning (e.g., syllables, affixes, compound words)

43. Distinguish between a word's denotation and connotation

44. Infer meaning from the order and sequence of words as well as the words themselves

45. Synthesize and infer meaning from simple verbal, spatial and/or mathematical data

H. **Reading to Generalize**

Given appropriate reading material, either prose or abbreviated sources, the adult will be able to do the following:

46. Draw conclusions from the facts given
47. Predict future events based on the facts given
48. Extend applications from the facts given

I. **Reading to Detect Fallacy or Persuasive Intent**

Given appropriate reading material, the adult will identify the following:

49. Fallacious arguments
50. Inconsistent facts
51. Illogical conclusions
52. Author bias in tone, use of emotionally loaded words and selective choice of information

Examples of Reading Tasks in Vocational Training

Use a catalog to order parts/merchandise.
Obtain information from a telephone book.
Review school policy, procedures, and rules.
Interpret product labels.
Understand safety signs.
Read directions for cleaning equipment.
Take written tests and exams.
Read instructional materials, such as textbooks, outlines, and shop manuals.
Interpret graphs and charts.
Use a map to locate a street.
Read a list of tools and materials to be purchased.
Interpret a bus schedule.
Understand step-by-step instructions for assembling an object.
Identify the parts of an object.
Read standard forms.
Locate library materials.
Learn new ideas from a trade magazine.
Read shop manuals for troubleshooting.
Proofread a list to detect errors.

Writing

A. Letters of the Alphabet

1. Given the letters of the alphabet in random order, the adult will write or print the letters in alphabetical order.

B. Copying Text and Drafts

2. Given written numbers, letters of the alphabet, words, sentences, and/or paragraphs, the adult will copy them correctly.

3. Given sentences or paragraphs organized in a rigid form (e.g., a business letter, report, etc.), the adult will copy them exactly.

C. Capitalization

4. Given a writing assignment that calls for capitalizing appropriate words, the adult will identify the words in sentences that should be capitalized.

D. Spelling

5. Given a writing assignment, the adult will spell common words correctly.

E. Punctuation

Given a writing assignment that calls for punctuation, the adult will correctly use the following:

6. Commas, colons, hyphens, semicolons, dashes, apostrophes, quotation marks
7. End marks
8. The singular, plural, singular possessive, or plural possessive forms of nouns

F. Handwriting

9. Given a writing assignment, the adult's penmanship will be legible enough to be read either in cursive or printed form.

G. Grammar

Given an appropriate writing assignment, the adult will use the following:

10. Regular and irregular verbs accurately in context with reference to tense and numbers
11. Positive, comparative, and superlative adjectives and adverbs in context correctly
12. Pronouns to take the place of nouns

SOURCE: Most items in this list have been reproduced with permission from Cooney (1980) and Dunn, Gray, and Martini (1982).

H. **Phrases, Sentences, Paragraphs**

Given an appropriate writing assignment, the adult will do the following:

13. Place modifiers correctly
14. Complete sentences
15. Use parallel construction to classify relationships emphasizing similarities and differences
16. Avoid run-on sentences and comma splices
17. Clarify meaning by subordinating
18. Use an effective sequence of sentences to form paragraphs

I. **Letters, Reports, and Messages**

19. Given an appropriate writing assignment, the adult will construct letters, reports, and messages using appropriate format and length.

J. **Forms and Applications**

20. Given a sample form or application such as for employment, Social Security, credit, etc., the adult will complete the form or application correctly and legibly.

K. **Dates and Time**

21. Given a date and time of day, the adult will write them accurately using correct punctuation and capitalization.

Examples of Writing Tasks in Vocational Training

Describe a machine malfunction.
Complete a work order form.
Fill out a time card.
Alphabetize material for filing or sorting.
List parts/items to be ordered.
Answer essay test questions.
Complete a customer complaint form.
Construct a safety sign.
Fill out an inspection report.
Record the behavioral observations of a patient.
Complete a sales receipt.
Record a telephone message.
Complete an accident report.
Take class notes and assignments.
Copy the serial number, model number, and brand name of an appliance.
Label materials/items for storage or display.
Keep a log of work trips.
Address correspondence.
Schedule appointments.
Outline a schedule of work.

Speaking

A. Selecting Words

Given an appropriate speaking situation, the adult will choose appropriate words that will achieve the following:

1. Avoid using inappropriate emotional words
2. Choose between technical and lay terms depending on the audience
3. Use slang only as appropriate
4. Communicate thoughts, actions, feelings, ideas, observations and inquiries effectively

B. Speaking Face to Face

Given a speaking situation, the adults will initiate, maintain, or conclude a conversation by doing as follows:

5. Pronounce words correctly and clearly given the constraints of the local dialect
6. Use appropriate cadence and inflection
7. Use appropriate body movements and tone of voice

C. Speaking over the Telephone

Given a speaking situation where a telephone is used, the adult will demonstrate the following:

8. Use associated services such as operator assistance, directory assistance, and the local directory
9. Use the correct technique for placing calls
10. Use proper protocol in identifying oneself and one's place of work and addressing the caller

D. Giving Information or Directions

Given an appropriate speaking situation, the adult will do as follows:

11. Describe orally, in a few short sentences, information about a given person, place, thing, or job performed
12. Describe an experience or some event that was witnessed (or read about)
13. Organize and express directions in a logical sequence
14. Explain to someone else how to perform a task, given experience at performing the task, or having learned from another person or a manual how to perform the task

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SOURCE: Most items in this list have been reproduced with permission from Cooney (1980) and Dunn, Gray, and Martini (1982).

Examples of Speaking Tasks in Vocational Training

Obtain and give telephone information.
Ask an instructor for explanations.
Ask customers clarifying questions.
Describe how something works.
Answer oral exam questions.
Order supplies, parts, materials.
Repeat a customer order.
Repeat or summarize a message.
Express an idea to improve a process.
Ask for assistance in a hazardous situation.
Communicate with a co-worker in a cooperative activity such as the installation of equipment.
Display appropriate protocol and courtesy to a dissatisfied customer.
Ask for directions.
Give instructions.
Describe an item or service for purchase.
Summarize a group meeting or activity.

Listening

A. **Literal Comprehension**
Given appropriate listening situations, the adult will listen for the following:

1. Obtain specific information
2. Identify procedures and directions to follow and/or to achieve some specific end
3. Understand general and technical concepts
4. Understand sequential and temporal relationships, including cause and effect relationships
5. Identify the correct meanings of words that sound similar but are different in meaning
6. State the meanings of selected words heard in context
7. Identify the main idea from a given speech that has just one main idea
8. List facts from an oral statement to support the main idea

B. **Interpretive Comprehension**

Given appropriate listening situations, the adult will listen for the following:

9. Use context clues to infer the meaning of unknown words
10. Draw conclusions from the facts given
11. Predict future events based on the facts given
12. Extend applications from the facts given
13. Identify what additional information is needed after hearing a conversation

Examples of Listening Tasks in Vocational Training

Detect abnormal noises in machinery or equipment.
Understand customer requests/complaints.
Record telephone messages/orders.
Understand safety instructions/warnings.
Comprehend oral exam questions.
Understand directions/instructions.
Determine questions to ask for further instructional clarification or explanation.

SOURCE: Most items in this list have been reproduced with permission from Cooney (1980) and Dunn, Gray, and Martini (1982).

APPENDIX B

THE CENTER FOR PUBLIC RESOURCES (CPR)
BASIC SKILLS SURVEY LIST

Reading Competencies

- The ability to identify and comprehend the main and subordinate ideas in a written work and to summarize the ideas in one's own words.
- The ability to recognize different purposes and methods of writing, to identify a writer's point of view and tone, and to interpret a writer's meaning inferentially as well as literally.
- The ability to vary one's reading speed and method according to the type of material and one's purpose for reading.
- The ability to use the features of printed materials, such as a table of contents, preface, introduction, titles and subtitles, index, glossary, appendix, and bibliography.
- The ability to define unfamilar words by decoding, using contextual clues, or by using a dictionary.

Writing Competencies

- The ability to organize, select, and relate ideas and to outline and develop them in coherent paragraphs.
- The ability to write Standard English sentences with correct:

  sentence structure
  verb forms
  punctuation, capitalization, possessives, plural forms, and other matters of
  mechanics
  word choice and spelling

- The ability to improve one's own writing by restructuring, correcting errors, and rewriting.
- The ability to gather information from primary and secondary sources; to write a report using this research; to quote, paraphrase, and summarize accurately; and to cite source properly.

Speaking and Listening Competencies

- The ability to engage critically and constructively in the exchange of ideas.
- The ability to answer and ask questions coherently and concisely, and to follow spoken instructions.
- The ability to identify and comprehend the main and subordinate ideas in discussions, and to report accurately what others have said.
- The ability to conceive and develop ideas about a topic for the purpose of speaking to a group; to choose and organize related ideas; to present them clearly in Standard English.

Mathematical Competencies

- The ability to perform the computations of addition, subtraction, multiplication, and division using natural numbers, fractions, decimals, and integers.
- The ability to make and use measurements in both traditional and metric units.
- The ability to use effectively the mathematics of:

  integers, fractions, and decimals
  ratios, proportions, and percentages
  roots and powers
  algebra
  geometry

- The ability to make estimates and approximations, and to judge reasonableness of a result.
- The ability to use elementary concepts of probability and statistics.

Scientific Competencies

- The ability to understand the basic principles of mechanics, physics, and chemistry.
- The ability to distinguish problems whose genesis is in basic mechanics, physics, or chemistry.
- The ability to apply basic scientific/ technical solutions to the appropriate problems.

Reasoning Competencies

- The ability to identify and formulate problems, as well as the ability to propose and evaluate ways to solve them.
- The ability to recognize and use inductive and deductive reasoning, and to recognize fallacies in reasoning.

- The ability to draw reasonable conclusions from information found in various sources, whether written, spoken, tabular, or graphic, and to defend one's conclusions rationally.
- The ability to comprehend, develop, and use concepts and generalizations.
- The ability to distinguish between fact and opinion.

SOURCE: Henry and Raymond (1983).

APPENDIX C

GENERAL EDUCATIONAL DEVELOPMENT LEVELS

Each occupation in the DOT has been assigned a series of subcodes which provide supplementary informaton about the occupation. One of these subcodes is for General Education Development (GED). The GED code is a three-digit number which indicates the reasoning (R), mathematical (M) and language (L) development levels that a worker should possess upon entering a given job.

GED levels range from one (1), the lowest level of complexity, to six (6), the highest level of complexity. The GED levels are cumulative; that is, each ascending level indicates a set of abilities and knowledges which are required in addition to all the abilities described at the lower levels. For example, a GED level of (R) 3, (M) 3, and (L) 3 means that a person must possess all the abilities listed in GED levels *1, 2, 3* for reasoning, mathematics and language.

The following charts, taken from *Relating General Educational Development to Career Planning,** further detail each of the GED's six levels for each factor (reasoning, mathematics and language) in terms of a composite of what is currently being taught in traditional academic settings in the United States. These charts do not address experimental or highly specialized training programs; therefore, the mathematical and language terminology may differ from that utilized in nontraditional settings.

It should be noted that the descriptions of the GED levels associated with the educational achievement composites differ from those in the later GED scale. This difference is due to the fact that the publication which contained the educational composites was published in 1971 while the revised GED scale was issued one year later. The Department of Labor, at the present time, does not have any plans to revise the publication, *Relating General Educational Development to Career-Planning*, in which the educational attainment composites are related to the GED levels. However, the basic principles and concepts remain the same and educators have found that they are still useful. Therefore, the charts relating educational attainment and GED levels are being included in this publication.

The information contained on the following pages can aid in the development of a curriculum which is reflective of occupational requirements in terms of levels of reasoning, mathematics and language needed for successful performance on the job. Later pages in this publication provide additional information about and specific examples for the utilization of GED levels for curriculum development.

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*U S Department of Labor. *Relating General Educational Development of Career Planning* (Washington: U S. Government Printing Office. 1971)

REASONING DEVELOPMENT	MATHEMATICAL DEVELOPMENT	LANGUAGE DEVELOPMENT
Apply common sense understanding to carry out simple one-or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job.	Counting and addition and subtraction of two-place numbers. Develop familiarity with standard units of measurement, and with basic measuring equipment, such as clocks, rulers, and scales.	Read, speak and print simple sentences containing subject, verb, and object, using present and past tenses.

MATHEMATICS CURRICULUM

Counting:	By twos, threes, fours, and fives.	
Space Value:	Understanding the principle of place value of whole numbers. Column value (in multiples of 10) in a series of digits: the number 6437 presents 7 ones; three tens; four hundreds; and 6 thousands. Value of zero as a placeholder; difference between 470, 407, 47.	
Roman Numerals:	Understanding principles of notation. Symbol to right, add: XI = 10 + 1. Symbol to left, subtract: IX = 10 - 1.	
Ordinal Numbers:	To the 31st. Learning proper ending: 1st; 2nd; 3rd; 4th.	
Addition:	3-place numbers: 567 +642	Decimal as c: 1.25 + .35
Subtraction:	3-place numbers: 359 -216	Decimal as c: 3.27 -1.16
Multiplication:	1-digit multiplier: 2.05 x .3	
Division:	1 digit divisor: $2\overline{)426}$	
Fractions:	Addition of simple fractions.	
Terms and Symbols:	Knowledge of signs such as -, +, =, $\overline{\quad}$. Introduction to terms such as sum, remainder, difference, multiplier, divisor.	

Measurement:	Read clock, calendar, thermometer, yardstick, scales. Knowledge of units such as teaspoon, tablespoon, cup, pint, quart, inch. foot, yard, dozen, ounce.
Geometric Concepts:	Reconize geometric forms such as line, square, triangle, rectangle, cube, cylinder, sphere. Understand meaning of terms such as "volume" and "perimeter."
Practical Applications:	Perform the four basic arithmetic operations with parts of a dollar.

LANGUAGE CURRICULUM

Punctuation:	Use of period, question mark, comma, exclamation point, quotation marks.
Capitalization:	Names of places, persons, days, months, years, titles.
Grammar:	Rote learning of correct usage of present and past tenses of common verbs, such as: run, do and go; and pronouns, such as: I, me, he, him, they, them.
Reference Works:	Introduction to the use of the dictionary and encyclopedia.
Spelling:	Learning to spell, through repetition and correction, words which are part of everyday vocabulary. Learning phonetic and structural principles.
Reading:	Introduction to the printed word. Emphasis placed on relating written word to spoken word; acquisition of vocabulary; reinforcing correct grammatical usage; stimulating thought.
Composition:	Emphasis on legibility, spelling, punctuation, initial capitalization, word order, and forming complete sentences and paragraphs.
Speaking:	Learning to participate in conversations and discussions. Emphasis on clarity, enunciation, pronunciation, grammar, and voice modulation. Oral reports, such as "Show and Tell," including information such as "who, what, where, when, and why."
Handwriting:	Mainly manuscript printing; introduction to cursive writing in 2nd and 3rd grade.

GED LEVEL 2 **(Grades 4-6)**

REASONING DEVELOPMENT:	MATHEMATICAL DEVELOPMENT:	LANGUAGE DEVELOPMENT:
Apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations.	Perform the four basic arithmetic operations, using whole numbers, and common and decimal fractions. Develop knowledge of standard units of measure, and their interrelationships.	Read, write, and speak compound and complex sentences using adjectives and adverbs, and varying word order in phrases, clauses and sentences. Discern and organize facts and opinions for written and oral communiation.

MATHEMATICS CURRICULUM

Numbers:	Read and write 7-digit numbers. Learn ordinals through 'thousands."
Counting:	By fractions and decimal factions.
Place Value:	Place values of numbers to left and right of decimal point.
Addition:	Multi-digit columns.
Subtraction:	Multi-digit columns.
Multiplication:	Two or three-digit multipliers.
Division:	Two or three-digit multipliers.
Division:	Two or three-digit divisors.
Fractions:	Add, subtract, multiply, and divide common and decimal fractions, mixed numbers, improper fractions. Introduction to ratio and rate, percent; change fractions to decimal fractions and to percent.
Part-Whole Relationships:	Introduction to reasoning and analysis of problems such as finding a part of a number; finding the whole when a part is given.
Geometric Concepts:	Learning meanings of terms such as radius, diameter, perimeter, circumference, area of rectangle and volume. Construct graphs, charts, and tables. Construct simple geographic forms such as arcs, triangles and perpendiculars.

Measurement:	Learn relationships of standard units of measurement to each other. Convert units of measure to smaller or larger units, such as inches to feet, acres to square miles, hours to days, minutes to seconds, or ounces to pounds.

LANGUAGE CURRICULUM

Punctuation:	Apostrophe, hyphen, colon.
Grammar:	Learn to use mature sentence forms (compound and complex) with variation of word order in phrases, clauses, and sentences. Introduction to comparison of objectives and adverbs; compound subject and predicate; agreement of subject and verb; common and proper nouns; personal pronouns; singular and plural forms.
Reference Works:	Study of the dictionary to learn syllabication accent and diacritical marks such as macron (-), breve (v), double dot and single dot as an aid to pronunciation. Study of road maps, time tables, and entertainment guides to determine distances between cities, report on transportation schedules and dicuss merits of availble entertainment. Obtain library card and locate books, using index file.
Reading:	Learn roots, prefixes, and suffixes. Learn to read discriminately, distinguishing between essential and unessential material. Enrich vocabulary with wide selection of reading material. Introduction to magazines, newspaper, bulletins, etc.
Composition:	Write reports on class discussions, hobbies, and trips, with emphasis on variety of sentence structure, grammar, selection of words to clearly express thought, and reinforcing and increasing vocabulary. Make outlines; practice techniques of letter writing and news writing.
Speaking:	Practice reading aloud to improve enunciation, pronunciation, inflection, and phrasing. Play a part in a skit, or act out a scene based on own experience to learn to express feelings vocally. Learn and practice courtesies in social situations such as allowing others to express their viewpoints without interruptions or ridicule. Relate personal experiences to group.
Handwriting:	Cursive writing; emphasis on legibility and facility in writing.

REASONING DEVELOPMENT:	MATHEMATICAL DEVELOPMENT:	LANGUAGE DEVELOPMENT:
Apply common sense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations.	Computer discount, interest, percentage, surface areas, values, weights, and measures, using four basic arithmetic operations.	Selective reading of textbooks, and other material to extract essential theme or idea. Compose themes, reports, and essays following rules of grammar, spelling, neatness and format.

MATHEMATICS CURRICULUM

Whole Numbers:

Mastery of the four basic arithmetic operations. Emphasis on speed and accuracy in computation. Extension to 4- and 5-digit multipliers and divisors.

Fractions:

Mastery of the four basic arithmetic operations in common, decimal and improper fractions and mixed numbers. Apply knowledge to solve "story problems." Develop speed and accuracy in changing fractions into percent and percent into fractions. Memorize most common equivalents, such as halves, quarters, eights, fifths, thirds, sixths, and twelfths, and mentally convert time to decimal fractions and percents.

Percentage Formulas: Memorize and apply formulas to solve "story problems," as:

$$P = RB \qquad R = \frac{P}{B} \qquad B = \frac{P}{R}$$

Measurements:

Perform the four basic arithmetic functions to solve problems involving different units of same type of measurement, as:

Time: 4 wks. 6 days 32 hrs.
+2 wks. 3 days 25 hrs.

Graphs:

Learn to construct and interpret line, bar, and picture graphs. Convert degrees to percent to draw circle graphs.

Percentage:

Apply knowledge of percentage to compute interest, discount, etc.

Geometry:	Recognize and understand meanings of terms such as horizontal, vertical, perpendicular, oblique and obtuse. Learn number of degrees in circle, relationship between angles and degrees, types of triangles: equilateral, isosceles, right and obtuse. Types of parallelograms: oblong, square, rhomboid, and rhombus. Learn formulas for finding area of geometric figures.
Albegra:	Learn use of symbols for numbers, terms such as exponent and power. Learn to find square roots.
Ratio & Proportion:	Learn to use ratio and proportion to solve problems.

LANGUAGE CURRICULUM

Punctuation:	Comma, colon, semi-colon, dash, parentheses, quotation marks, hyphen, abbreviations.
Reference Works:	Utilize dictionary to learn alphabetical order, guide words, diacritical marks, synonyms and antonyms. Use encyclopedia, atlases, magazines, and source books to prepare class assignments.
Handwriting:	Develop individualized style of writing.
Grammar:	Learn concepts of person, gender, number, case, tense, mood, and voice. Learn kinds of verbs, nouns, pronouns, adjectives, adverbs, conjunctions, prepositions. Learn to diagram sentences. Learn normal inverted word order, contractions, agreement of subjects and verbs, pronouns, and antecedents.
Reading:	Read to find main thought or idea of a paragraph. Locate topic and summary sentence, and identify details and relate them to central thought.
Composition:	Prepare themes, reports, and essays, with greater emphasis placed on punctuation, spelling, grammar, format, style, neatness, arrangement, and comprehensive coverage of subject matter.
Speaking:	Practice speaking before an audience to acquire poise, self-control, and confidence. Participate as group leader or group member in planned informal discussion. Participate in class elections and persuade others to vote for her or his candidate.

GED LEVEL 4 **(Grades 9-12)**

REASONING DEVELOPMENT:	MATHEMATICAL DEVELOPMENT:	LANGUAGE DEVELOPMENT:
Apply principles of rational systems to solve practical probems and deal with a variety of concrete variables in situations where only limited standardization exists, interpret a variety of instructions furnished in written, oral, diagrammatic or scheduled form.	Perform arithmetic, algebraic and geometric operations as applied to standard situations; perform shop mathematics operations in practical application to the manual arts.	Speak on a variety of subjects, or compose business letters, reports, summaries or expositions conforming to rules of grammar, continuity, diction, coordination, length of harmony and sequences of sentences and paragraphs.

MATHEMATICS CURRICULUM

Algebra:	Formal study of number systems; sets, and set operation. Operations on polynomials and rational expressions; solution of equations and inequalities; use of deduction and proof. Study of the systems of real numbers; linear, quadratic, rational, exponential, logarithmic, angle, and circular functions; inverse functions; related algebraic functions, limits and continuity, probability, and statistical inference.
Geometry:	Study of deductive axiomatic geometry, plane, and solid, using the properties of real numbers; the introduction and use of rectangular coordinates. Extension of trigonometry and solid geometry.

Technical/Vocational School

Shop Math:	Review and extension of principles of common and decimal fractions, percentage, ratio, and proportion. Practical computation, logarithms, slide rule. Practical algebra. Metric geometry. Essentials of trigonometry. Formulas for computing ratios of pulleys and gears. Practical physics: formulas for work and power, etc.

LANGUAGE CURRICULUM

Punctuation:	Review and mastery of all rules of punctuation and capitalization.
Reference Works:	Dictionary, encyclopedia, atlas, thesaurus, manuals, periodicals, newspapers, journals, books, and play reviews.

Grammar:	Mastery and facility in the use of the rules and concepts of person, gender, number, case, tense and mood.
Parts of Speech:	Verbs: Strong and weak, transitive and intransitive auxiliary, regular. Conjugation.
	Nouns: Common and proper, collective, concrete, and abstract inflections; gender.
	Pronouns: Personal, demonstrative, relative, numerical, reciprocal.
	Adjectives: Common, proper, descriptive, limiting, articles position in sentence; comparative degrees.
	Adverbs: Simple, conjunctive; forms; comparison.
	Conjunctions: Coordinating, subordinating.
	Interjections.
	Prepositions.
Reading:	Variety of textbooks, newspapers, and magazines.
Compositions:	Preparation of outlines; preparation of themes, emphasizing length, harmony, sequence, and variety of sentences and paragraph structure. Selection of wordage according to subject matter and audience. Coordination, subordination and parallelism of thoughts.
Speaking:	Participation in panel discussions and dramatizations. Practice of social introductions and other amenities. Presentation of impromptu speeches to develop skills in extemporaneous speaking.

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